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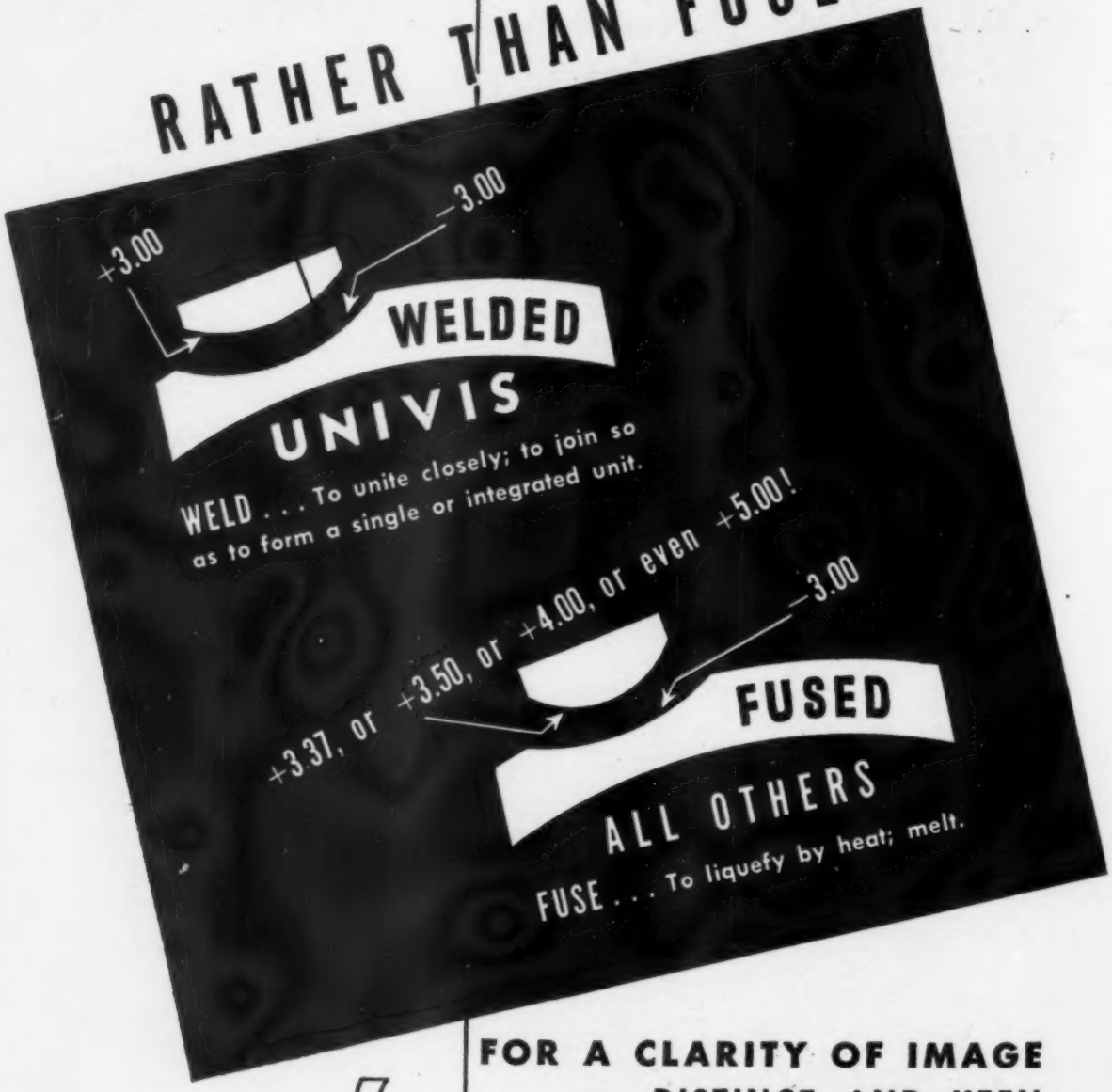
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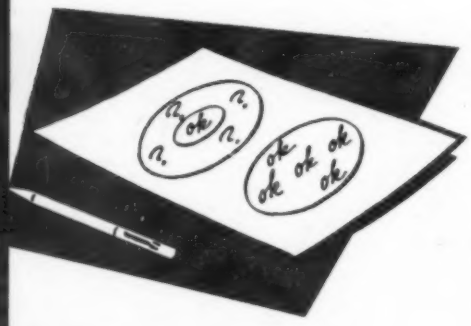

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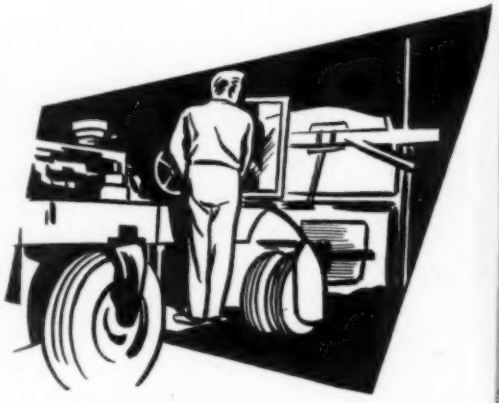

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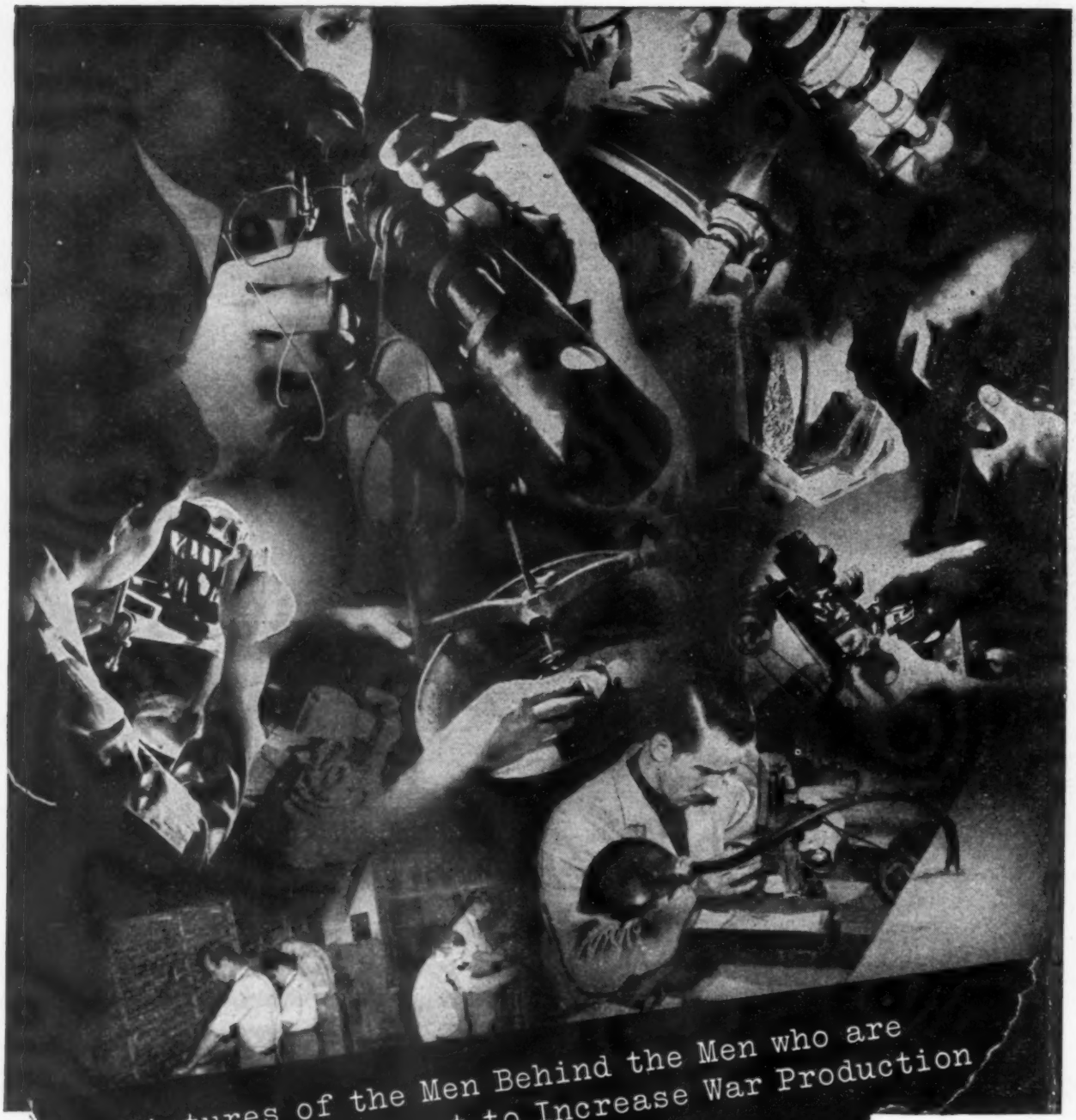

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AN ERGOGRAPHIC ANALYSIS OF FATIGUE OF ACCOMMODATION*

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School of Optometry
Ohio State University

History and Introduction

In 1914 Lancaster and Williams[1] made what was perhaps the first attempt to produce fatigue of accommodation experimentally. Their methods included prolonged reading of fine print, prolonged focusing on test objects at the point of maximum accommodation, repeated attempts to clear test objects nearer than the punctum proximum, and forward and backward pursuit of a test object through the range of accommodation. Their tests for evidences of fatigue were periodic determinations of the punctum proximum during the course of the experiment and determinations of the punctum remotum at the beginning and at the end of the experiment.

Their apparatus consisted of a sliding test-object carrier moving freely on an optical bench with a millimeter scale. The movement of the test object was forward and backward, horizontally, along the line of sight of the eye being tested.

They reported that both the punctum remotum and the punctum proximum were brought nearer to the eye in their attempts to produce fatigue. They found in some cases that even after an hour the punctum proximum continued to approach the eye although at a slower rate. In other cases the curves showed signs of falling off after about half an hour. They found the subjective sensations of fatigue surprisingly small. Figure 1 illustrates the results from one of their experiments.

The first to employ a self-recording device for the study of the fatigue of accommodation was Lucien Howe.[2,3,4] His apparatus, like that

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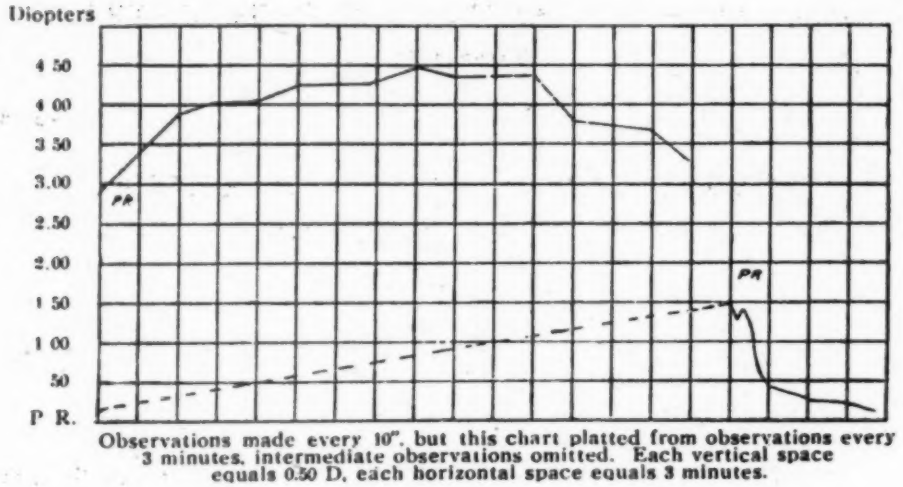


Fig. 1. (Lancaster and Williams) "Curve of punctum proximum (P.P.), continuous fixation of test object as near as possible for forty-five minutes, followed immediately by the curve of punctum remotum, continuous fixation of the test object as far off as possible, wearing a +2.00 D. lens. Note the characteristic increase in power to accommodate, followed in this case by a definite falling off after about half an hour —fatigue."

of Lancaster and Williams, consisted of small letters for a fixation target and a sliding target carrier on a horizontal bar. The target carrier, however, was connected to a smoke-drum recording device which enabled him to obtain a continuous record of the distance of the target from the eye during a test period of successive monocular push-ups.

Howe's reports indicate that a fatigue curve is the usual type of record to expect. Figure 2 illustrates one of his average curves. In fact, he went so far as to classify patients into six groups ranging from those who showed no fatigue throughout the testing period to those who showed almost immediate fatigue.[4]

A report on the occurrence of ergographic fatigue of accommodation was made by Berens and Stark[5] in 1932. They used a modified and improved form of Howe's ergograph with a card of small letters for the test object. The range of excursion of their test object was very short, however, so that the base-line of their graphs, i.e., the starting point for each successive push-up, was only about 20 mm. beyond the average near point of accommodation. Their tests lasted from 10 to 15 minutes, this length of time permitting a series of, roughly, two or three hundred successive push-ups in a single test period.

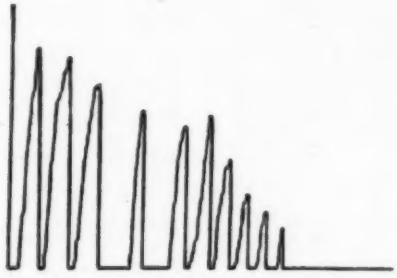


Fig. 2. This figure is given by Howe to represent an average tracing as registered on his ergograph. This tracing is made on a revolving drum. No ordinate or abscissa values are given, but from the context it is understood that the base line is from 20 to 33 cm. from the eye, and that the duration of the test is less than 15 minutes. The upper extremities represent successive monocular near points of accommodation.

Their study of 195 office patients showed a decrease of amplitude within a 15-minute period of 30.8 per cent of the cases. About the same number showed an increase, while the others showed no change. They disagree with Howe's statement of fatigue being the usual thing.

Blatt[6], of Rumania, devised the *accommodatometer*, an apparatus similar to the types described above, for investigating the fatigue of accommodation. He reported a rapid recession of the near point of accommodation and long recovery periods in patients with various types of diseases. He suggested that the influence of these diseases on the accommodative ability was dependent upon their toxic effect on the accommodation center in the brain.

In 1938 Kurtz[7] carried out a series of tests on seven subjects to determine whether there was any decrease in amplitude of accommodation resulting from reading for 30 minutes under conditions in which practically all of the available amplitude of accommodation had to be used. It was found that only one subject showed a considerable decrease in the amplitude of accommodation in his fatigue tests, the other six showing practically no change. This one subject decreased from an average of 7.5 D. to 5.1 D., an average decrease of 2.4 D. The measurements were made with minus sphere lenses with the target at 33 cm.

A review of the papers outlined above gives ample evidence that there are individuals who do manifest a recession of the near point of accommodation when submitted to prolonged accommodative tasks. In general, this phenomenon is referred to as a type of fatigue of accommodation. It is with this phenomenon that the present paper is concerned.

One of the questions that has been raised in regard to this recession

of the near point was on the possibility that the blurring of the letters was a result of retinal fatigue dependent on continuous fixation of an object rather than a result of improper focusing dependent upon fatigue of accommodation. Lancaster and Williams believed that they had eliminated retinal fatigue as a factor by letting the subject frequently change the fixation from one letter to another on the chart. Berens and Stark verified their fatigue cases to be accommodative by the fact that the target was always cleared when it was made to recede a sufficient distance.

A test that was applied to several of the ergographic fatigue cases included in the present report was that of suddenly placing a weak convex lens before the fatigued eye and asking the subject to report whether or not the test target became clearer or more blurred. An alternate check test was that of using a weak concave lens instead of a convex. The combined reports of "clearer" with a convex lens and "more blurred" with a concave would indicate that the fatigue was accommodative and not retinal. All of the cases tested in this way indicated that the blurredness was dependent upon an insufficient amount of accommodation.

Another test that was successfully performed in one case was that of suddenly changing the occluder from one eye to the other during a recession of the near point. The fatigue proved to be continuous, which was what would be expected if the fatigue were accommodative, but which would not be true if the fatigue were retinal.

Apparatus and Procedure

The ergographic testing apparatus used in this investigation consisted of a movable fixation target mounted on a optical bench. A diagram of the apparatus is given in Figure 3. A phorometer trial frame, with

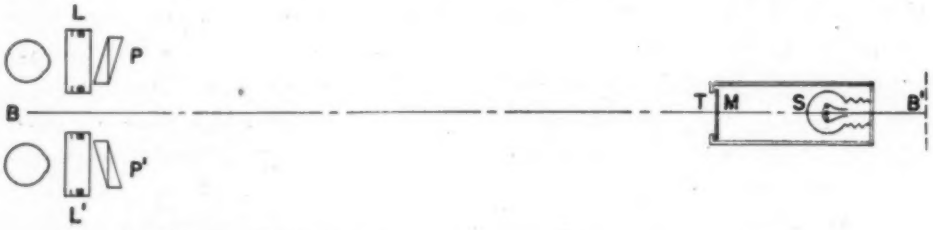


Fig. 3. Diagram of apparatus.

removable rotary prisms (P and P′) held the necessary correcting lenses (L and L′) and was so fixed that the moving fixation target (T) followed the median sagittal line (BB′) of the subject's head. A forehead rest on the phorometer trial frame held the subject's head in position.

By adjusting the forehead rest, the back surface of the nearest lens in each lens cell (L and L′) was made to correspond to the spectacle plane, 14 mm. from the tip of the cornea. The phorometer trial frame was adjusted to correspond to the inter-pupillary distance as measured in the spectacle plane when the subject fixated at 40 cm.

The fixation target (T) consisted of a transilluminated, photographically reduced print of a standard Snellen chart of letters mounted in the end of a brass cylinder one and one-half inches in diameter. The cap which held the target in place provided a circular aperture one inch in diameter. A plate of opal glass (M) diffused the light from a frosted 7½ W. lamp (S) mounted in the other end of the cylinder. The photographic print was reduced to 1/38th the size of the original Snellen chart, the letters of which ranged from 200 to 10 foot letters.

A chain drive connected the target carrier with a set of reduction gears which moved a pencil forward and backward so that a continuous record of the movements of the target was made on the time graph. A crank handle on the chain drive made it possible for either the subject or the operator to move the target forward and backward. The operator, however, controlled the movements at all times except on occasions when adjustments had to be made on the apparatus or on occasions when it seemed worthwhile to determine whether or not any difference in the recorded results would occur when the subject himself moved the target. No differences could be observed.

The speed of approach of the target was intentionally varied to prevent rhythmic responses. There were, of course, many cues that the subject could depend upon to aid him to make a desired record, but since it was possible that many of these cues may have acted as additional stimuli to accommodation, no attempt was made to eliminate them. In fact, the subjects were frequently urged to put forth more effort during the course of the test. Any technique, as for example, blinking, by which the subjects were able to increase their amplitudes was encouraged, although partial closing of the lids to form a smaller effective pupil was not allowed.

The degree of blurredness that was reported as a blur was arbitrarily decided upon by each subject. Each subject was instructed not to report a blur until there was no doubt in his mind that the limit of his accommodation was reached, and he was further instructed to try to maintain the same criterion of blurredness throughout the test. Changing the fixa-

tion from one letter to another in a given row of letters was used to prevent the possibility of a blur from retinal fatigue.

Three types of procedure were employed in the attempts to produce fatigue:

1. Sustained effort. The target was placed at various distances from the eye until the smallest letters that the subject could read at any distance were determined. These letters were then used for fixation. The target was first brought slowly toward the subject (one eye being occluded) until he reported a blur; then the target was slowly moved away until the letters became clear; in this manner the target was repeatedly moved to the "blur" and to the "clear" throughout the duration of the test. This type of procedure requires a continuous effort of accommodation and provides no opportunities for the accommodation to relax.

Figure 4 represents a typical record from this technique.

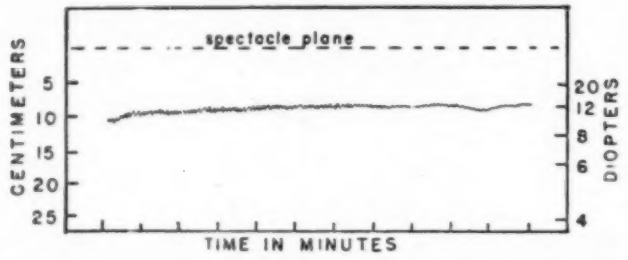


Fig. 4. Tracing of an ergograph record obtained by the sustained effort technique.

2. Repeated efforts. The target was placed at the far end of the optical bench and the smallest letters that the subject could read were determined. These letters were then used for fixation. The target was first brought toward the subject until a blur was reported; the target was then quickly moved to the far end of the range. This procedure was repeated for the duration of the test. The subject fixated the same row of letters throughout the excursion of the target.

This test was made both monocularly and binocularly. The limit to which the target could be made to recede was 40 cm. so that the stimulus to accommodation was reduced to 2.50 diopters between push-ups.

Figures 5, 6, and 7 are records obtained by this technique.

3. Alternation of distant and near accommodation. This procedure

is the same as the repeated effort procedure except that instead of continuously fixating the moving target, the subject fixated the letters on a

Fig. 5. Tracing of an ergograph record obtained by the repeated effort technique. All of the curves were obtained within the period of time included in the graph.

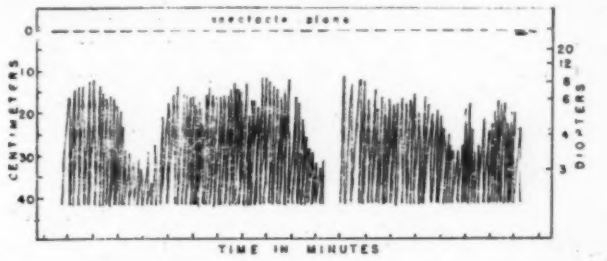


Fig. 6. Tracing of an ergograph record obtained by the repeated effort technique.

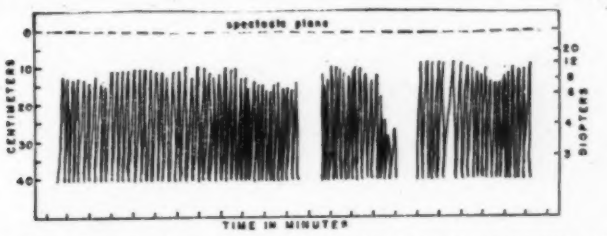
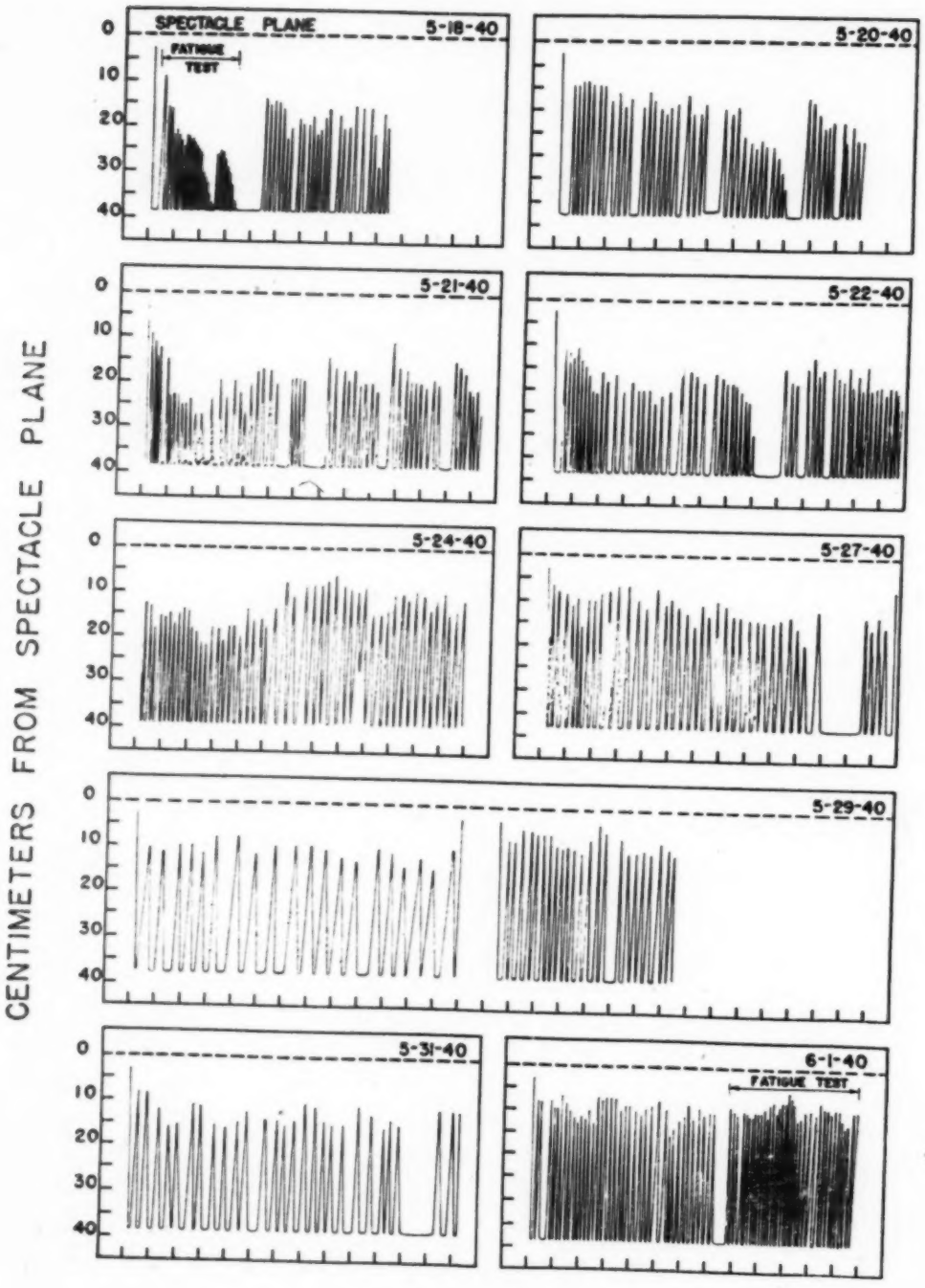


Fig. 7. Tracing of an ergograph record obtained by the repeated effort technique. The first break in the graph represents a failure of the recording device during the test; the second break represents a rest period.

chart at 5 meters while the target was being moved to the far end of the scale, and the next push-up was not started until the letters at 5 meters were reported clear. This requires almost a complete relaxation of accommodation between the repeated push-ups.

Figure 8 illustrates a series of records obtained by this technique.

Another method of producing an alternation of stimulus for distance and near was occasionally employed. In addition to the subject's distance correction, a + 3 D. lens was placed in the lens holder. This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FATIGUE TEST
5-20-40
5-21-40
5-22-40
5-24-40
5-27-40
5-29-40
5-31-40
6-1-40
FATIGUE TEST
0
10
20
30
40
CENTIMETERS FROM SPECTACLE PLANE
TIME IN MINUTES

Figure 8

brought the subject's far point of accommodation within the range of the movement of the ergograph target. By slowly moving the target away until the letters blurred and then bringing the target toward the eye until the letters again blurred, alternately obtained measures of the far point and near point of accommodation were recorded by the ergograph.

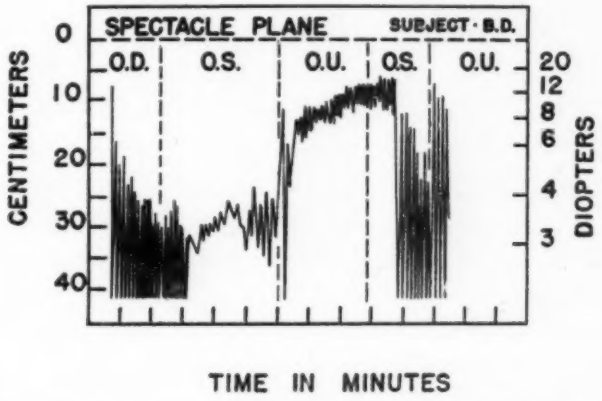

Fig. 9. A tracing of a record obtained with successive changes in procedure. The dotted lines indicate when the changes were made from one eye to the other or from one eye to both. The strokes reaching the base line represent repeated efforts. Those not reaching the base line were obtained by the sustained effort technique.

Figure 10 illustrates a record obtained by this technique, the sections with the short strokes representing intermittent periods during which the sustained effort technique was employed.

The subjects used in the investigation were mostly college students. A large number of these were patients from the eye clinic of the School of Optometry who were given the special tests when it was suspected that they might manifest an ergographic fatigue of accommodation. The others were Optometry students who volunteered as subjects. All of the subjects were corrected for their distance refractive errors during the test.

Results

A minimum of twenty minutes of the sustained effort test was given to each of a group of 19 students whose ages ranged from 21 to 33. Each of the subjects began the test with an amplitude that was con-

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Fig. 8. A series of ergograph records obtained on one individual. The parts labeled "fatigue test" represent the simple repeated effort technique. All of the others were obtained by the technique involving an alternating relaxation of accommodation by clearing a distant acuity chart between successive push-ups. The numbers indicate the dates on which the records were made.

sidered normal for the subject's age, the lowest, 6.50 D., belonging to the oldest subject in the group. Almost without exception the records followed a consistent pattern. Figure 3 is the first half of one of the records; this record was selected as most representative of the group. The first period of the test in every case except one showed an increase in amplitude. This period of increase varied from about one to ten minutes. Following the increase, the amplitude stayed at a very constant level with a few records showing an occasional slight recession like the one seen at about the tenth minute of the tracing in Figure 3. In no case did the final amplitude decrease below its initial one. The one subject who manifested no increase held a constant amplitude throughout the test.

Most of the subjects in this group could offer no specific symptoms of discomfort or fatigue during the test, except for a general type of fatigue or uneasiness that may have resulted from the steady posture and attention required during the test. The specific symptoms that were reported included "watering of the eyes," "itching" sensations in and around the eye, headache, and periods of "burning." These symptoms did not continue after the test was stopped.

One of the subjects reported a severe headache on the evening following the test and attributed it directly to the experiment. However, a recheck a few days later gave a record practically identical to the first and was not followed by any headache. Another subject reported a "blurring of distant objects" that lasted about five minutes immediately following the test. That this was dependent upon a temporary nearsightedness was indicated by the fact that he could see clearly through a pair of —.50 D. lenses held before his eyes. When the symptom of "blurring" disappeared, his acuity no longer improved with minus lenses.

The sustained effort technique was frequently employed as an inincidental test on subjects who showed fatigue by other techniques. The change in technique was usually made without an interval of rest. As a rule such records showed a rapid return to an amplitude higher than was obtained by any of the repeated effort push-ups, as illustrated in Figure 10. In this figure the first period shows a slight recession of the near point of accommodation when the technique involved the total range of accommodation; the second period shows a rapid increase in amplitude obtained by the sustained effort technique. The third period shows a recession with subsequent irregular values of the amplitude followed by an almost immediate approach to the maximum in the fourth period when

the sustained effort technique was employed. The last few minutes for the right eye showed no certain signs of a recession although the values did become quite irregular. A test on the left eye after a one-minute interval of rest again illustrates a fatigue by the alternating technique with a rapid recovery when the sustained effort technique is employed.

Those who did not show a recovery of this type did not, however, show any further increase in fatigue. A representative record is illustrated in Figure 9. The first two and a half minutes show a continuous reces-

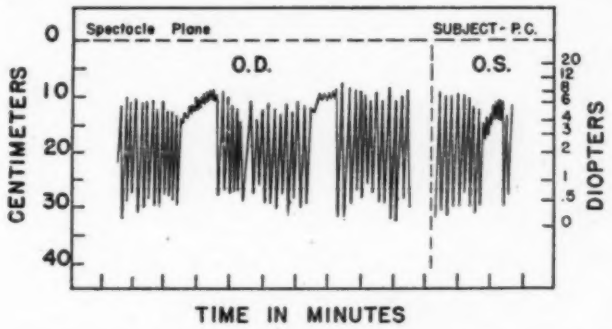

Fig. 10. A tracing of a record obtained with successive changes in procedure. The dotted line indicates the change from right eye to left eye. The subject fixated the test target through auxiliary lenses of +3.00 diopters in addition to the correcting lenses. The long strokes represent excursions between the far point and near point of accommodation. The short strokes were obtained by the sustained effort technique. (The diopter scale at the right differs from that of the other figures because of the +3.00 auxiliary lenses.)

sion of the near point monocularly by the repeated effort technique. The fatigue is seen to be continuous from one eye to the other. A change to the sustained effort technique during the third minute, however, brought a stop to the near point recession. Although the figure shows some recovery it is probably insignificant when compared to the initial amplitude of the right eye, or to the subsequent amplitude obtained with the left eye in the same figure.

The repeated effort technique produced fatigue records more frequently than either of the other techniques. Even by this method, however, the records that showed fatigue were very infrequent. As a rule, when fatigue was manifested at all it was obtained within the first ten minutes of the test, for many of the tests which elicited no recession of the near point within the first few minutes were continued for periods of 20 minutes or more and showed no subsequent tendency to fatigue.

The most striking example of fatigue by the repeated effort tech-

nique is illustrated in Figure 5. The subject was tested on three successive days and manifested a fatigue each time. The tracings in Figure 5 were made at one sitting in the order and time sequence indicated. First the right eye showed a rapid fatigue. A few seconds' rest period during which the occluder was changed permitted the left eye to start at almost maximum amplitude, but it also showed a rapid fatigue. A recheck of the right eye substantiated the original right eye record. The fact that the fatigue is not continuous from one eye to the other in this example is dependent upon the interval of rest between the tests and is not to be mistaken as evidence that the eyes fatigue independently.

The occluder was then removed and the test was made binocularly. No fatigue was elicited, nor was any fatigue elicited binocularly on this subject on any other day although the test was on one occasion prolonged for over 20 minutes.

The higher amplitude obtained binocularly in this example is consistent with similar comparisons made on the subjects. Whatever may be the explanation of this, the important consideration to be given to the fact here is that since the binocular amplitude is higher, it must involve an amount of ciliary activity at least equal to if not greater than that of the monocular amplitude.

The fatigue shows a repetition of the monocular fatigue in a recheck on the right eye after about a two-minute rest period. The subject was unable to report any specific subjective symptoms of fatigue or discomfort, merely an inability to clear the letters. A routine refraction showed no unusual refractive or muscular anomalies, the subject's only visual complaint being that of occasional blurred vision at both distance and near.

Another example of a fatigue record from the repeated effort test is illustrated in Figure 6. This subject had no visual complaints and was surprised when fatigue was manifested. A routine refraction showed 3 diopters of astigmatism in each eye which had been properly corrected for several years. He wore his glasses during the test, with the left eye occluded. He could offer neither an explanation nor a description of what happened at any of the recession periods, except that he could not clear the letters. He was given an opportunity to close his eyes for a rest as represented by the break following the second recession. When he opened his eyes again, his accommodation responded normally at first but showed a subsequent fatigue near the end of the test.

No immediate after-effects were noted, although on the evening following the test he reported a headache. The headache, however, was of a type that he occasionally had had and which had been diagnosed as migraine. The test was repeated several days later and no fatigue was elicited and no after-effects were reported.

A third example of fatigue from the repeated effort test is illustrated in Figure 7. The first break in the record was caused by a failure of the recording device to operate; the repeated push-ups were continued during this period. The fatigue occurred rather suddenly and was verified as accommodative by the plus lens technique described above. A few seconds' rest with the eyes closed brought the response back to normal. The test was done monocularly. No after-effects were reported and no subsequent tests were made. A routine refraction showed no anomalous refractive or muscular errors and no glasses were prescribed. The figure also illustrates one of the exceptions to an above statement that when fatigue was manifested at all it was as a rule manifested during the first few minutes.

The technique involving alternation of distant and near accommodation was not employed so much as a fatigue test as an exercise to see what improvements could be made in those who showed susceptibility to fatigue in the repeated effort test. These records as a rule did not show as great a susceptibility. Because of the alternate clearing of the distant target there was usually a loss of time between push-ups which resulted in a smaller number of push-ups per minute. That this factor may play a part in the forestalling of fatigue is indicated, for example, in the first record of Figure 8. In this tracing the fatigue test consisted of about 4 minutes of repeated effort technique. After about a minute's rest, the push-ups were repeated, but this time with a distant acuity chart to be cleared between push-ups. The time necessary to clear the distant target is represented by the separation of successive push-ups at the base of the graph. A comparison of the two tracings in this record shows the decreased susceptibility to fatigue by the alternating technique.

The remaining records in Figure 8 represent a series of training periods on the same subject using the alternating technique. The intervals between successive push-ups in these remaining records are not dependent only upon the time necessary to clear the distant target but also include pauses that were introduced whenever the subject anticipated a fatigue or whenever it was suspected that a short pause might bring about a more favorable response. In other words, since this series was intended as an

exercise rather than as a test, the subjects' suggestions for bringing about an improvement were given every possible consideration.

Several observations can be made from Figure 8. First of all, a comparison of the fatigue tests at the beginning and the end show a decreased susceptibility to fatigue. In general, there are fewer recession periods in the later records than there are in the first. Secondly, it is hardly possible to associate any consistent changes in performance with changes in frequency of push-ups within the range of the frequency permitted by the alternating technique. In the record of 5-29-40, for example, the deliberate attempt to increase the frequency was followed by an improvement in performance, whereas in other records it appears that a recession in the near point could only be forestalled by increased intervals between push-ups. And, finally, although the average amplitude obtained in the later records is greater than that obtained for the earlier records, there is no evidence that the maximum amplitude has increased, for the amplitudes obtained in later tests do not exceed by any significant amount the amplitudes obtained in the initial push-up. That the initial amplitude was not erroneous was verified by several measurements of the amplitudes not recorded on the ergograph.

The subject who submitted to this series of exercises was a woman 22 years old. Her only subjective complaint at the time of her first visit to the clinic was that of blurring at distance, which was accounted for by a refractive error of —.25 O.U. She could report no specific benefit that may have been derived from the exercises except that her distant vision seemed clearer. There was no change in refractive error evident, however.

A similar series of exercises was given to a 14-year-old boy who showed a recession of the near point of accommodation on the ergograph. A routine examination showed no anomalous findings but his complaint was an inability to read for more than half an hour without a "tiring and burning" of the eyes. During the first ergograph test he reported an "itching and burning" similar to that obtained when reading. Subsequent tests and exercises showed a decreasing susceptibility to fatigue.

As in the above series, there was no evidence that the maximum amplitude had been increased, and it was not possible to associate any consistent changes in performance with changes in frequency of push-ups within the range of frequency permitted by the alternating technique. The final test was made on a day when he reported having read a book for four hours without discomfort. This test was of the repeated effort

type and constituted the sixth of the series. No susceptibility to fatigue was then indicated.

Another series of ergographic exercises was given to a man 36 years of age, whose maximum amplitude by various methods of measurement was three diopters. His complaints were essentially those of a presbyope, namely, blurred vision at near and eyestrain from reading. A routine examination showed no refractive errors or muscular imbalance. To make certain that his difficulties were not of binocular origin, he was provided with a monocular occluder which he wore for two evenings of regular reading; this gave no relief. Similarly the convergence was eliminated as a factor by the wearing of base-in prisms of small degree for two evenings and the wearing of base-out prisms of small degree two evenings. The prisms produced no favorable reports.

The series of 10 ergographic exercises were provided during a period of four weeks, with no more than one exercise on any given day. In addition to taking these exercises this patient spent considerable time outside of the laboratory trying to increase his amplitude by frequent push-ups. No recession of the near point was obtained in any of the tests. Although the records became more consistent there was no evidence of increase in amplitude. The subjective reports of symptoms during the tests corresponded to those obtained when an excessive amount of near work was attempted, but, as the series was continued, the exercises successively produced less and less subjective fatigue to the point where no difficulty was encountered in doing a full 20-minute test. No noticeable relief from his difficulties in reading and near work was obtained, however.

A reading add of +1.00 D. was finally prescribed and has been worn satisfactorily for more than a year. A recent check on the ergograph indicated a very slight reduction in amplitude, as might be expected with an increase in age.

In addition to the preceding descriptions of the nature of the records obtained by the various techniques there were several observations made that are more easily discussed in terms of the type of response involved than in terms of the type of test given.

The first of these is concerned with the unpredictableness of the fatigue curves. Attempts to predict whether or not a given individual would or would not show recession of the near point on the ergograph were unsuccessful in spite of the fact that data from the routine eye examinations and the case history were available. Likewise, an analysis of

the data from the routine eye examinations and the case histories of those who showed ergographic fatigue gave no evidence of an anomaly or a combination of anomalies that was common to the group. The unpredictableness was borne out as well in attempts to estimate from one moment to the next what the trend of the near point would be. This can be appreciated by the reader if a sheet of paper is made to cover any part of a single record in Figures 5 to 10 and an attempt is made to estimate the trend of the near point in the section covered by the paper. The lack of success will be evident even if the paper covers but a single stroke. In other words, one can neither interpolate nor extrapolate accurately from any curve that might be drawn in to represent the trend.

The second observation concerns the repeatability of the fatigue records. It was pointed out above that a retest was made of the subject whose record is shown in Figure 6 and that the second record showed no resemblance to the first. One student was tested twice with an interval of five months between tests. The first test one showed no fatigue but the second one did. Another subject showed a very definite and steady recession of the near point in an 8-minute test. An attempt to retest the individual a few minutes later for demonstration purposes resulted in a normal record with no recession whatsoever. In general, it seemed to be true that if an individual showed fatigue on two or more successive tests he could be expected to show it in subsequent tests, but a single fatigue record in many cases could not be repeated.

The third observation concerns the nature of the return to a normal amplitude that often occurred during the course of a test in which a recession had been manifested. Whenever the near point was observed to recede during the test, the subject was urged to put forth more effort with the result that in many instances the response became normal again. This was true in spite of the fact that the subject clearly understood the necessity of maximum effort when he started the test. In other instances, the normal response suddenly followed a continuous recession for no apparent reason at all. Sometimes a slight distraction such as someone's entering the room, a change in sitting position, or a spontaneous cough, was followed by a return to a normal response. Usually a few seconds' rest involving free glances around the room sufficed to obtain a normal response. In general the return to a normal response, when it occurred, was extremely rapid. The resulting ergograph record would show an abrupt termination of a fatigue trend by a normal or near normal

response. An example of this sudden recovery is seen in the last record of Figure 5.

In addition to the above observations and measurements there was made a series of phoria measurements immediately before and after a number of the ergograph tests. The phoria test was made by placing 8 prism-diopters of prism base down in front of the left eye to prevent fusion of the images and adjusting the rotary prism in front of the right eye until the subject reported the two images of the target vertically aligned. During the phoria test the subject read aloud the fixation letters in the upper image to insure a constant amount of accommodation in play. The fixation target was set at 40 cm. during the test. The series of phoria measurements before and after each test consisted of first, a phoria test, through no lenses, second, through a pair of +2.00 lenses, and, third, through a pair of —2.00 lenses. The average of the three phorias obtained before the ergograph test was subtracted from the average obtained after the ergograph test to give a measure of the increase in convergence induced. Obviously, a minus value would represent a decrease in convergence. These values for four subjects are shown in Table I.

TABLE I. THE EFFECT OF THE ACCOMMODATIVE FATIGUE TEST ON THE PHORIAS.

Subject	Eye Tested	Duration of Test	Av. Phoria before test	Av. Phoria after test	Inc. in Conver.	ACA before test	ACA after test	Incr. in ACA
W.D.	O.D.	11′	2.5 exo	3.5 exo	—1.0	4.7	3.3	—1.4
H.L.	O.S.	3′	0.5 exo	1.0 eso	1.5	3.5	3.0	—0.5
H.L.	O.D.	3′	1.0 eso	1.5 eso	0.5	3.0	3.5	0.5
J.W.	O.D.	8′	3.3 eso	5.7 eso	2.4	3.8	3.8	0.0
E.J.	O.D.	12′	4.0 exo	5.3 exo	—1.3	4.8	4.1	—0.7

These phoria tests also gave a measure of the ratio of accommodative convergence to accommodation, i.e., the number of prism diopters of change in phoria induced by one diopter of accommodation. This, for convenience, is called the A.C.A. ratio. Thus, if the —2.00 lenses produced 4 esophoria and the +2.00 lenses produced 8 exophoria, the change in phoria would be 12 prism diopters for 4 diopters. Dividing 12 by 4 gives an A.C.A. ratio of 3. Since each series consisted of three phoria tests, it was possible to compute the A.C.A. ratio for each combination

of two of the three tests and to average these to represent the A.C.A. ratio as recorded in Table I. The A.C.A. ratio obtained before the ergograph test was subtracted from the A.C.A. obtained after the test to represent the increase in ratio induced. A minus value of course indicated a decrease in A.C.A. ratio.

Since the manifestation of a fatigue curve could not be predicted, it was necessary to make the phoria tests in a large number of cases to obtain data from those who showed fatigue. Of those so tested four showed a decrease in amplitude during the test. The results from these four are tabulated in Table I.

The figures in the table indicate that there is no increase in the A.C.A. ratio, but that there may be a slight increase in average convergence. The few data provided, however, are not sufficient to make these results statistically significant.

It is of some interest to consider in this connection the results obtained in 46 cases which did not show a fatigue. The tabulation showed no statistically significant changes in the A.C.A. ratio, but did show a highly significant increase in convergence. This is in accord with the changes indicated in Table I for those who showed a fatigue. It is also in accord with some data in the report of Berens and Stark which indicated a tendency toward more esophoria immediately following a fatigue test. However, their data were insufficient to indicate whether the increased esophoria is due to an increased A.C.A. ratio or due to a general increase in tonicity of the extra-ocular muscles. The results in this investigation showed the latter to be true. To summarize, it may be said that immediately after an ergographic test a subject is to be expected to show greater esophoria, or less exophoria, but no change in the ratio between accommodation and accommodative convergence; there is no indication that the results from those who manifest an ergographic fatigue are different.

Discussion and Conclusions

A number of points at which fatigue may be considered to occur in the accommodative mechanism are:

1. The ciliary muscle
2. The myo-neural junction
3. The ciliary ganglion
4. The nucleus of the third nerve
5. The higher centers of the brain.

Peripheral to the third nerve nucleus the structures subserving accommodation are completely paired. That is to say, peripheral to this nucleus there are no known connections that would permit innervations to accommodation to have any effect on convergence. The relationship between the innervation to accommodation and the innervation to accommodative convergence must be established before the streams of impulses start down these paired pathways.

On this basis it must be assumed that if fatigue occurs in the nucleus of the third nerve or below, i.e., at any one of the first four points listed above, an increased innervation to accommodation would be necessary to produce a constant response. For example, more innervation to accommodation would be required to produce clear vision at 40 cm. during such fatigue than would be necessary in the absence of fatigue. The increased innervation would manifest itself by an increased A.C.A. ratio. The fact that no change in the A.C.A. ratio was evident indicates, therefore, that the seat of the fatigue would lie at some point higher than the nucleus of the third nerve. This would exclude the peripheral synapses and the ciliary muscle, and place the fatigue in the higher centers of the brain.

Further indication of the probable location of fatigue is offered by the comparison of ergograph records obtained binocularly and monocularly. In two instances, in this investigation, a binocular ergograph test was made when the monocular test showed fatigue. In both cases, no fatigue could be elicited binocularly. One of the examples is illustrated in Figure 5. This can only indicate that none of the first four of the five points listed above can be considered as the seat of the fatigue for there is no difference in the activity at these four points dependent upon the change from a monocular to binocular stimulus.

Similar results on the comparison of binocular and monocular fatigue have been reported by Berens and Stark. Their report contains two cases of fatigue obtained in monocular tests which show no fatigue binocularly.

A comparison of the records obtained by the repeated effort and the sustained effort techniques indicate that fatigue is elicited more readily by the former. The same is shown by a comparison of the results of Kurtz, and Lancaster and Williams, who used sustained effort techniques and the results of Berens, Howe, and Blatt, who used repeated effort techniques. The former reported almost no fatigue cases, whereas the latter

found a considerable number of them. And finally, the difference in susceptibility to fatigue in the two techniques is evident when both types of test are given to the same individual. This is illustrated in Figure 10. It would be expected that the sustained effort represents greater muscular effort than the repeated effort. On this assumption, the fatigue could not be attributed to the ciliary muscle itself.

Another observation which would tend to exclude the peripheral mechanism of accommodation as the seat of fatigue is the lack of correlation between the individuals who manifest fatigue and the individuals whose amplitudes of accommodation are insufficiently adequate to permit satisfactory vision for close work such as reading or sewing. If a correlation existed, a beginning presbyope who wears a reading add, even though his measured amplitude is still just sufficient to permit clear vision at the reading distance, would be expected to manifest a fatigue more readily than one who has a sufficiently adequate accommodative mechanism to permit its prolonged use without the aid of a reading add. Such an argument is, of course, not particularly convincing, but it is of some significance that there seems to be no relationship between the adequacy of the accommodative mechanism and the occurrence of ergographic fatigue.

Along the same line is to be considered the lack of correlation between the individuals manifesting fatigue and the individuals who report symptoms when prolonged close work is attempted without a lens correction which would reduce the necessity of great amount of accommodation. This is true even when convergence difficulties are eliminated as possible factors, as described in the preceding section. Furthermore, many who reported no subjective symptoms of fatigue showed a rapid recession of the near point on the ergograph. And finally, there appeared to be no correlation between the subjects who showed an ergographic fatigue and the subjects who reported subjective fatigue while taking the test.

In addition to the above factors which tend to eliminate the peripheral mechanism as the seat of the fatigue, there are a number of observations included in the results which are difficult to explain on the assumption that the fatigue occurs as a simple physiological reaction of any given part of the peripheral mechanism. The facts that the occurrence of fatigue is the exception rather than the rule, that it has in general been found unpredictable, that it often disappears with motivation, and often apparently spontaneously, that the recoveries are so sudden, and that the recession of the near point itself is often so rapid as to be entirely out of order when considered in the light of the subject's normal ocular activ-

ities all point to the probability that the influencing factor lies in the higher centers of the brain. This indication is in agreement with Blatt's suggestion that the decrease of accommodative ability in his subjects was dependent upon toxic effects produced on the accommodation center in the brain.

In summary it may be said that this paper has attempted to describe the recession of the nearpoint of accommodation as it sometimes occurs in various types of ergographic tests and to list the observations made in connection with these tests that seem to point to the origin and location of the seat of the fatigue. The results obtained indicate that the recession of the near point cannot be attributed to fatigue factors in any of the peripheral parts of the accommodative mechanism, but rather that the seat of the fatigue must be located above the nucleus of the third or oculomotor nerve.

It has not been possible to attach any diagnostic significance to the occurrence of ergographic fatigue of accommodation.

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VITAMINS IN VISUAL DYSFUNCTIONS*

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While much attention is being given to the general nutritional deficiencies of the body and the subsequent lack of vitamins by certain medical specialists, it appears that more attention should also be directed to this important subject by optometrists.

Not that we are suggesting that optometrists prescribe for these deficiencies when present, but rather because in certain of these cases it appears that visual problems are present and that visual problems are at times corrected by directing the patient's attention to nutritional questions.

A review of the literature indicates that certain cures are reported. Cures of night blindness for instance by increasing the intake of vitamin A. In fact there has been so much discussion of this subject that the public now believes vitamin A to be the "eye vitamin." The literature indicates however that some disturbances of vision cover a much broader field and that the results obtained by the proper and skilled use of other vitamin therapies in selected cases seems often just as important.

Because as optometrists we have rather exacting examination techniques resulting in a high type of well screened specific findings we may be able to assist in the matter of determining the results of these therapies when used under proper skillful care. If certain vitamin deficiencies result at times in visual dysfunctions such as night blindness, color blindness, neuro-muscular disorders, central vision and visual field defects, these can be both diagnosed and evaluated from time to time as the patient undergoes care at the hands of his specialist who is prescribing for his nutritional problems.

Assuming the eyes reflect these conditions, optometrists may assist in the determination of findings on which further treatment may be prescribed. And in this optometrists should always stand ready to cooperate with other professional men when called upon to do so.

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It is also well to understand that some of our problem cases may also result from nutritional deficiencies, and in these cases it may be well to have the advice of specialists in this field.

A review of the literature indicates that a lack of vitamin A in certain cases may result in blepharitis, conjunctivitis, styes, hemeralopia, defects of central vision, retrobulbar retinitis, keratonized epithelium, xerophthalmic, etc.

The review also indicates that a lack of vitamin B and G in certain cases may result in general neuro-muscular asthenia, nervous instability, neurasthenia, cataract, severe headaches, as well as conjunctival and retinal problems.

The review also indicates that a lack of vitamin C in certain cases may result in lenticular changes, cataract, myopia and hemorrhagic retinitis.

The review also indicates that a lack of vitamin D in certain cases may result in cataract, generally in cases where other symptoms of rickets are present.

These and other syndromes, not presented in these short notes, indicate the need for keeping in mind at all times the nutritional side of health work, and in those certain problem cases, securing for the patient the proper measure of well-rounded technical skills the case may require.

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"OPTOMETRIC REFRACTIVE SERVICE BUILDS"

The present National Crisis calls for the growth of Optometry and consequently a corresponding development of professional education. Professionalized during the First World War, and showing great progress during the Great Depression, our profession must continue to advance. This is particularly true now, as World War II creates new dependency, sickness and demoralization with its collateral expansion of health work and of the professional sociological viewpoints.

Great as is the need, proper optometric expansion cannot take place without sufficient qualified personnel. Optometric practice must have trained professional workers; optometric educational practice must have

high-calibre young persons to train. There are today less than twenty thousand professionally trained optometrists to do the millions of refractions now needed, and enrollment in the schools of Optometry is dropping.

The armed forces require certain optometric services, and on the home front, war aggravates old ocular weaknesses and creates new ones. Homes are disrupted, and nerves are on edge; the wholesome influences by which children chart their lives are dispelled, bringing visual problems to the fore; war industries, with their refractive cases, mushroom in places ill equipped to care for them; housing shortages develop along with the need for recreation and the lack of school facilities, all requiring additional eye care. To meet these needs, new optometric services must be created, old ones strengthened and expanded and education in optometry must likewise be adjusted realistically.

Into the new pattern of social living that is forming—war living—optometry must build with great strength, not only for the present but for the future. For after the war, peace will bring new adjustments, new tribulations; and the character that optometry can now build into its practice will be sorely needed, then as now. Optometry has a big job to do.

But Optometry cannot do that job without competent personnel. And as the concept of professional optometry broadens and deepens, the standard of competency rises.

"Optometric Refractive Service Builds." That is today's concept of optometry—a far cry from the "optical-shop" of bygone days when the sale of glasses was the practitioners usual way of meeting his obligation to society. Now the emphasis is constructive and preventive service—service planned to cope with present and future eye problems; with all forms of ocular hazard; service that arrests refractive maladjustment while still arrestable; service that strives to plan wisely for the patients future visual care.

To perform such service, students of vigor and insight are required; students who are not easily discouraged, who have faith in the future and who like human beings. Flexibility they must have, common sense, resourcefulness, a sense of humor, and a desire to help their fellow men.

But beside their innate capacity, they must also possess the acquired knowledge and skills that are the nucleus of optometry as a profession. For as optometry expands, innate capacity or ordinary technical training

is not enough. Professional understanding and techniques are demanded too; and the knowledge of eye care that is required of them is constantly increasing. State Board and Academy professional optometric examinations, for instance, specify the highest type of professional training as a condition of admission; and future merit system examinations under Federal and State civil service for optometrists working under public health services, will make similar requirements.

To fill such needs and positions, there have never been enough well trained optometrists. Optometry should (and has been) one of the most rapidly growing of professions. Professional optometrists having doubled in numbers in the last ten years, and the supply of professionally trained optometrists has never caught up with the demand. Especially since 1935, with the expansion of the ocular hygiene programs, has the gap been wide. Now, with the war urgencies constantly draining off personnel, the gap is wider still.

To make matters worse, schools of Optometry are losing students. Nine of the accredited schools of the Association of Schools and Colleges of Optometry had less enrollment in 1942 than in 1941. This year may show a further drop. This at a time of sharpened demand for graduates, when schools should not only be using their facilities to capacity but expanding them!

Continuance of this downward trend would be disastrous. For if there are abnormal losses of experienced optometrists and also a drying up of the source of replacement, ocular refractive programs will be crippled. Thus, it is the concern of optometric practitioners, as well as educators, to see that enrollment in the schools takes an upward turn.

In this practitioners can do much. Optometry is not well known as a profession. Many persons are unaware that optometrists receive good professional incomes. Nor is enough done to bring before young people the challenge of optometry as a career—the fact that a most interesting special training is needed for this professional field and that a good living can be made in it. Optometrists can help to dispel this cloud of ignorance. They can be less tight-lipped about their work, talking more about what optometry offers as a career, its financial compensation, and its inner satisfactions. They can also publicize the way to prepare for the practice of Optometry. And they can explain why long preparation is necessary —that the nature of the responsibility optometrists assume, dealing as they do with human vision, deserves the utmost in accumulated wisdom and skills.

What is not less important, optometrists can ensure that they themselves are giving their utmost in wisdom and skill by keeping abreast of new knowledge through graduate professional schools.

How the schools of optometry are adjusting to the needs of the times is a story in itself. All have "defense committees" that work with a variety of war-born activities. Accelerated programs through reduced vacations, staggered courses changed from the semester to the quarter system have been adopted as part of the new war-time program. Curricular changes are likewise numerous, the problem being to preserve a suitable balance between the immediate and the ultimate need.

Thus, the task of optometry as regards optometric education is twofold: (1) to increase enrollment in the schools so that the supply of optometrists will equal the demand; (2) to orient school programs to both present and future exigency. Professional Societies, like the Academy, and national associations like the A.O.A. are all working on the job side by side with the Association of Schools and Colleges of Optometry. The task is too large for optometric education alone. The guidance and effort of optometrists in practice must also be enlisted.

On the efforts of practitioners in this regard may well hang the difference between optometry's success or failure in meeting the challenge of these crucial years.

CAREL C. KOCH.

SPECIAL REPORTS

A SURVEY OF OPTOMETRY'S POSITION*

A REVIEW OF THE PROFESSIONAL ADVANCEMENT PROGRAM

Ewing Adams, Opt.D.†
Detroit, Michigan

Emergency, evolution, and war alike uproot and trample under foot everything weak or relatively useless in their pitiless pathway—individuals and professions not excepted. Today optometry cannot hope to come off unscathed; cannot hope to survive unless and until she faces this fact and acts accordingly. Optometry barely has time to step aside

*An abridgment of the material appearing in "Optometry the Profession." 1942-1943.

†President, American Optometric Association.

and look at herself against today's and tomorrow's background. She must recognize herself as weakened and uncertain yet dangerously complacent. She must forthrightly and without hesitation take steps to husband her strength, and with conviction stand her ground courageously in the cause of visual eye care.

In this matter of visual eye care the public's interest transcends all other considerations. Thinking based on any other concept is doomed to failure. At most, nothing more than temporary profit can develop from narrow, selfish approaches to the subject of eye care, regardless of disturbing local practices which, because they are close, seem all-important. Unsound as some of these practices may be, no lasting solution is attainable until the broad needs are recognized. True objectives must be established and sought through organized effort.

Utmost in importance is a realization of what is impending, or at least a recognition of all that can be envisioned by those willing to face realities, rather than indulge in wishful thinking.

It will avail us little to rehearse the shortcomings of some optometrists, or to dwell on the incompetence of some eye physicians. Better that we admit the need for housecleaning in both professions, as well as among the suppliers who service them. Better that we bend our energies toward establishing optometry on a plane where society will recognize and accept true professional services only on a basis earned by ethical administrations.

There are many conflicting theories regarding what is in store for us, and what the status of the individual in tomorrow's world will be. But there is one conclusion reached and agreed upon by educators, students and officials, both here and abroad. The practices of yesterday will not be the standards by which tomorrow's successes are measured.

That conclusion holds true for professional and commercial enterprises alike, and there are discernible reasons for it. Many of the trends that crystalize this thinking are taking place in foreign lands. In some respects the signposts are already clearly marked in the United States.

Only the "die-hards" will fail to admit the errors of yesterday, or concede the need for much of the social legislation which has already been enacted. This legislation is but a manifestation of the evolution that goes with progress.

Better that we face realities and recognize the social evolution that

is taking place. Better that we realize how fortunate we are to be in the enviable role of being equipped to serve society according to tomorrow's rules—the rules that are gradually and inevitably taking form.

Optometry is a profession. This statement never would be questioned if all optometrists practiced according to the ethical standards that any one of us would endorse. But, unfortunately, neither optometrists nor physicians honestly can claim the ideal, and public confidence is frequently lacking. Altogether too large a proportion of the public believes that it is paying too much for too little. Unfortunately, this is true—not among the optometrists and ophthalmologists who accept and execute their responsibilities to society, but among those elements of both professions who trade on professional credentials and the reputations of their peers.

Wherein, then, lies optometry's future? Recognizing the welfare of the public as the prime consideration, it certainly is not a question of whether optometrists or ophthalmologists render the necessary services, but rather a question of whether both professions fill the public need for proper and adequate eye services.

If you *believe this*—as against giving passing lip service to the thought—you will instantly recognize that the ophthalmologist and the optometrist alike are indispensable factors in the rendering of adequate eye service. There is no *real* conflict between the two professions, for there are too few optometrists and too few ophthalmologists to render the eye services which the public needs today and will demand increasingly tomorrow.

Today a mechanical war places greater demands on eyesight than ever before. Visual efficiency and eye comfort are vitally important and should enjoy priority. Optometry may well be proud of the indispensable part she performs in making possible the greater and still greater visual performance so vital to our industrial workers and armed forces. Tomorrow, in peace, visual adaptation and rehabilitation will be added requirements which optometry must serve.

Many who have access to the pulse of the public and to the legislative intent of our present law-making bodies are convinced that these two forces are both driving toward the same objective, although motivated by different urges.

Scarcely a person will deny that a definite social and economic evolution is taking place within our boundaries. Attribute it to what

you will, you will arrive at the conclusion that the public, in ever-increasing numbers, will not be content with the practices of yesterday. The public will measure results tomorrow by the character of the services rendered, rather than by the price tag on a pair of glasses.

Of course this will not be a hundred per cent true of all people, but it will be true in a proportion large enough to affect those who would not have given it more than a passing thought in years gone by. Service rendered the public will establish economic security for those of us—including optometrists—who, today, will embrace tomorrow's opportunity. The men who can furnish such service will be far too few to take care of the people who see visual efficiency and eye care, rather than glasses as such.

Left to itself, and expedited by war activities and postwar needs, this social evolution is sufficient in itself to create a new standard. It remains only a question of when. But clearly before us is another force which gains its legislative incentives from two sources: first, political expediency—the necessity that stems out of anticipating the desires of the public—and, second, dictatorial aspirations which seek to control and dominate American institutions and enterprises in the name of public benefits. In any event, the evolution will be implemented by laws, if not actually decreed ahead of the recognized needs. Public opinion must be met and satisfied with an enlightened program that recognizes and provides for public needs on a fair and equitable basis.

This evolution applies not only to optometry and ophthalmology, but reaches into every walk of life. Any philosophy that does not accept it as inevitable and provide for its needs is destined to failure. But we are concerned with the welfare of the public as it is affected by visual efficiency and eye care, and as it is served by optometrists, ophthalmologists and ophthalmic dispensers. We must be.

Let us repeat. The public is not primarily interested in the name under which an individual practices. It must know his profession by name and know what that name stands for. But it is chiefly concerned —and will be more so—with what it gets for the dollar it spends. Here again, the issue is not between ethical practitioners of the two professions, but rather between them and the other elements in both professions who will not accept their responsibilities to society. The ethical practitioners in optometry and ophthalmology have established their relation to society. The real problem lies in the lack of public

confidence created by the claims of incompetents who trade under the state optometric or medical licenses.

Optometry's answer will be found in a carefully planned and organized national effort, which will establish its true objectives and approach them without fear or favor. We must recognize the weaknesses of our growing period and admit them. Admission will disarm those who condemn all optometrists because of the actions of relatively few.

Disruptive influences are not confined to optometry, by any means, but optometry is being challenged in the Court of Public Opinion. This challenge must be met, and it is not unreasonable to expect—in fact, it can be predicted with certainty—that the other elements, professions and industry alike, will follow the leadership established by optometry.

There can be only one sound reason why we attack this problem, and that is in the interest of public welfare. True, if you want to go deeper into what motivates our interest in public welfare, you may call it self-interest. But it is *intelligent self-interest*. We are self-interested in that we want to benefit individually, but we know it must not be at the expense of the public or of any ethical practitioner.

We want optometry to be recognized by all that truly professional men stand for. We want to do our part in rendering the public service, for which there is dire need. We want to earn and receive fair remuneration for services rendered. We want recognition from the Government and the public for just what we are—optometrists, skilled in our profession. We want optometry to earn and enjoy an improved relation to society.

By coordinating acts, but not by the methods of obstructionists, we want to protect the science of optometry from any tendency toward regimentation. We want to accomplish desirable social results without destroying that which we have spent our lives to attain. We want to serve the public in the manner for which our education and experience fit us.

EMERGENCY PROGRAM OF THE A.O.A.

How can this be accomplished? Listen carefully as our A.O.A. plan unfolds. Recognizing the needs, it will provide the machinery for accomplishing our objectives. It will reach out into every state, city and hamlet. It will call for active participation by greatly increased numbers of optometrists, and will be productive in direct proportion to

their efforts. We must embrace the opportunity which the A.O.A. plan can and will afford us.

Our needs are well known and the results attainable in national optometric unity. But in order to attack our problems intelligently, it is necessary to portray the social backdrop against which optometry is silhouetted; against which optometry's faults stand out; against which our ethical and economic adjustments must be made. Yes, against that same social background and side by side with optometrists stand the figures of the opththalmologist and the ophthalmic dispenser in equally bold relief. They must be considered in dealing with optometry's situation.

Optometry, the profession—first legalized in 1900 in America—answered the need for a more adequate visual service. The American evolution of optometry—the science of correcting ocular defects—has been astonishing. Its development has been the most rapid of any profession. A recital of its accomplishments in forty-two years sounds like a miracle. It is—the miracle being that during the development period so many members were provided who possessed the talents, vision, industry and devotion necessary to establish optometry's educational foundations, develop its clinical techniques and procedures, create its ethical standards of practice, and guide its professional advancement. In spite of its splendid record of progress, optometry still finds itself discounted professionally and its services not accepted by many important public groups and official agencies.

Today, as the people of the world pass through the greatest social revolution in history—nations, institutions, individuals and traditions are being wiped out. In these inevitable changes, optometry is vulnerable. Her roots are not as deep in the service and tradition of the people as some longer established professions. Social revolutions have always been, as this one is, ruthless and concerned only with saving that which is vital to society. Optometry is threatened. Now and here she must prove her social worth.

We ourselves are well aware of how vital to the wellbeing of the people is the visual service rendered by optometry. But that very knowledge may blind us to the need for enlightening the public. We must arouse ourselves and face a startling possibility. We must recognize that because of this lack of proper information concerning optometric service and value, situations could arise, in the present confused state of social revolution, which might, intentionally or unintentionally, eliminate optometry.

Social and economic usefulness, availability and adaptability, are factors underlying the very existence of every institution, profession and, in the final analysis, of every individual. Social values upon which these considerations are based are, in great measure, determined by quality and quantity. Effectivity is multiplied by numbers—by the part played by each individual in the whole social picture. Optometry's greatest weakness lies in decreasing numbers. Quality—one factor in optometry's effectivity—has been greatly stepped up because of increased education and the resulting application to visual problems. But the other factor in optometry's social effectivity—quantity—has decreased slowly during the last few years, is now decreasing rapidly, and bids fair to pitch down sharply.

Pennsylvania's actuarial studies show that even optometry's present numbers are deceiving. Many of those making up the total number in optometry are now over sixty years of age. Their numbers will decrease rapidly and in accelerated fashion during the next decade.

Our intake is badly crippled. As optometry's educational standards increased, enrollments slowed down. National emergency and selective service cause further decrease in the enrollments. The war, with no deferments for optometric students, further seriously threatens opportunity's life blood. Enlightened student procurement will furnish it.

Optometry has suffered a shrinkage of approximately 23% since 1920. Facing the facts just mentioned, optometry faces a much more serious shrinkage in the next decade, and one which will develop rapidly.

Optometry's indiscriminate practices and confused economics have contributed largely to the serious public misconception regarding eye care. Ethical standards must be raised, so that the professional practice of optometry will flourish in the warm, reflected glow of favorable public opinion. Unfavorable public opinion must be directed toward the unethical commercialized forces which attack and weaken optometry. Sound economics will have to be learned and practiced. Uniform ethical and economic considerations are vital if optometry is to correct the existing public misconception of the true values in visual eye care.

In the past, public relations has been a rather vague program with optometry, as can be seen by the small amount of money set aside for its cultivation. Public relations must be carried on extensively and intensively, down to the last small group in every section of the United States, in order that optometry's social status may better be established.

Student procurement, ethical practice and good public relations are vital. They can be accomplished only through organization. The A.O.A. represents at present only about 45% of the practicing optometrists and only about 30% of the registered optometrists.

To meet this threat to our professional existence, it will be necessary for every individual optometrist to cooperate in a united program of activities, which will include four "musts." Here they are:

1. Every optometrist must be a member of the A.O.A.
2. Every optometrist must influence desirable men and women to study optometry as a career.
3. Every optometrist must adjust his practice to ethical, professional standards, based on a factual concept and evaluation of the economic factors involved in rendering services to the public.
4. Every optometrist must cooperate in the Public Relations Program which will present professional services as the true values in eye care.

The A.O.A. must secure the complete cooperation and support of at least the practicing optometrists. In that way, and in that way only, can the other three "musts" be achieved.

Mistaken indeed is the concept that the power of an organization springs alone from its leaders. Power and strength spring from the masses. As a rule, organizational power and influence, like responsibility, are in direct proportion to organizational size. The larger and more powerful an organization becomes, the more is expected of its officers. Administrative officers in an organization such as the A.O.A. must either lead or yield the load to those who will. Your A.O.A. officers elect to lead.

Organization is greatly needed in emergencies, and today optometry is at a critical juncture. The A.O.A., strengthened and with worthy objectives, will enable optometry to survive and increase its usefulness to society. But an organization's first importance to individual members lies in its ability to make its members proud of "belonging." A great, strong, central organization, working for standards important to its members, can assure elevation, security and increased usefulness.

With the A.O.A. as the base of optometry's pyramid, built large and powerful, and widened to give greater stability, membership in it grows increasingly important to the individual. The larger a professional organization becomes, the more valuable is membership. Add to that,

the cumulative value of sound objectives and you have organizational reward in its greatest measure. We need not examine the possibilities of loss.

THE A.O.A. OBJECTIVES

What are the A.O.A. objectives? There are many. However, five are outstanding. For optometry we seek:

1. Raised ethical standards.
2. Student procurement; high standards of education; more and better teachers.
3. Improved relations with ophthalmology.
4. Recognition as a profession by the public.
5. Recognition as a profession by the Government.

Optometry's light, though burning, has been obscured by the deplorable practices of the commercialized optometrist. But commercialized racketeering serves only to underline the conviction of the profession as a whole that ethical considerations are essential and must come first.

Sound changes can steadily be brought about through the adoption of our A.O.A. philosophy, which recognizes professional eye services in their true relation to visual efficiency and eye comfort. Rationalization prevents some individuals from seeing clearly the fallacies of their unsound practices, and they must be exposed. Every optometrist must be influenced to recognize sound beliefs and action, in order that optometry may be free to fill out its dimensions as a profession. It is here that a strong, united A.O.A. can be most effective.

The A.O.A., with increased strength, will lead optometrists in sound thinking. It will be a strong influence for effective, professional outlook and action on the part of every optometrist. It will furnish the yardstick for the highest standards of ethics. It will indicate the most effective way of solving the problems of optometry, the profession. In strength, the A.O.A. will protect optometry's investment in knowledge, experience and specialized services from lay invasion in any form and on any front where its subtle, sly, debilitating influence appears. The public is no better equipped safely to examine and prescribe eye care for itself than it is to prescribe for any other physical failure.

An optometrist's duties to the public are the primary consideration of his service, because optometry is a profession. An optometrist's sense of responsibility to his profession is the measure of its "esprit de corps"

and the challenge to his ethical conduct. An optometrist's attitude toward his fellow optometrists is no less important, but more personal and intimate.

One of the A.O.A.'s most important considerations concerns the life blood of optometry. Optometric colleges, as well as optometric schools in universities, have been depleted. The prospects for the immediate future are uncertain. Startling actuarial figures indicate the need for enrollments in greater numbers than optometry has ever dreamed of expecting. If we are to stop the decrease in the numerical strength of optometry, great numbers of optometric graduates are needed. And quality is all-important. Through the Office of Student Procurement, our greatest endeavor must be to offer optometry as an opportunity, all over the country, so that all states may aid in the program of revitalizing our schools and developing good new material for optometry.

What can be done to bring about the deferment of students entering optometric schools? Can optometry find students for the optometric colleges who will be allowed to complete their courses and furnish the new material so badly needed in optometry? These are questions vital to our existence.

Women are being brought into business and industry in increasing numbers. They are being prepared and trained to fill the positions made vacant through loss of manpower. Why not apply that same reasoning to optometry? Why not go out into the educational institutions and engage the active interest of women, young and older, in studying optometry? We know it to be a profession in which women could be eminently successful. And that's not all. Infusion of fine, sensitive, intelligent, adjusted womanhood into optometry's life stream might well exert a gratifying influence in the years to come.

After the last war, optometric colleges were few in number, not particularly attractive and, in the main, were teaching short courses in optometry. Despite that, the Government, in its rehabilitation program, made it possible for men to study optometry. Later several states, Michigan, Illinois and others, made optometric education available for citizens who had been crippled or handicapped in civil life.

Today, optometric schools are more numerous. They are attractive to students and are becoming more so. Present-day optometric courses are well planned and make ample provision for training thorough, efficient practitioners. Continued advancement should bring desired recog-

nition in educational circles. Government today, viewing all problems primarily from the sociological standpoint, is anxious to train and rehabilitate wounded soldiers and sailors. Should optometry offer its facilities to the Government in this and any other capacity in which it can offer, directly or indirectly, adequate ocular service to the public?

Accelerated courses are already effective in optometric colleges. The A.O.A. must insure future optometry against abbreviated, low-standard courses which would cause the profession to lose the ground already gained in building our colleges to their present stature.

Optometric teachers are needed and will be even more seriously needed as our Student Procurement Program gets under way. What will be the source of optometric teachers and instructors in the future? Will scientists in other fields of education be attracted to our schools in the capacity of instructors?

Question after question is raised in connection with optometric education. It was always thus. Today, with much at stake, optometry realizes that nothing demands more earnestness of thought and endeavor.

Optometry, the profession, has long sought greater recognition by medicine—in particular, by ophthalmology. Acceptance of optometry by medicine, by ophthalmology, is one of the primary objectives we propose. Optometry is worthy of this recognition. Its schools in universities, and its independent colleges, have raised the standards of refraction. Optometry has kept itself informed and interested in post-graduate education.

Sooner or later, optometrists and ophthalmologists will join in a common program, to correct the public misconception concerning eye care. Many are seriously attacking that problem now. Disturbing elements in both fields profit parasitically from the public misconception which places value on the "price of glasses," rather than on the professional and technical services rendered by ophthalmologists, optometrists and ophthalmic dispensers. It is human, natural, and inevitable for a common problem to result in mutual concern. Separately and individually, ophthalmologists and optometrists may be approaching the correction of this public misconception. Eventually, their efforts must merge into a concerted attack. United effort will be victorious, and the public's misconception will be corrected.

Sooner or later, optometry will, through the guidance of its national association, be accorded greater recognition, but only because of

its increased usefulness to society. Optometry's affairs will be conducted so that there will be no serious conflict in optometry's contacts with ophthalmology. Conflicts serve only to delay and slow down combined, effective effort.

Optometry must secure greater public recognition. Public recognition in what respect? Optometry must be recognized by the public as a profession. But optometry cannot be esteemed as a profession by the public until it deserves such status. It awaits recognition as a profession until the public has been educated to place primary emphasis on professional services in eye care. Optometry can secure greater public recognition by correcting vigorously the public misconception which places the emphasis on the "price of glasses" in eye care.

The Office of Ethics and Economics, in the present Professional Advancement Program,[1] has before it the task of indoctrinating optometrists everywhere with an accepted philosophy concerning the relationship which exists between the services rendered and the devices used in visual eye care.

How is the individual optometrist to find his place and do his part? The answer lies in the A.O.A. and its objectives.

We must raise ethical standards. We must revitalize our colleges. We must seek and deserve recognition by ophthalmology, by the public, and by the Government. These A.O.A. objectives will be attained.

We have a well-established organization. Through it, a united drive must be made toward all these objectives. We have the materials, the method, the will. How shall they be put to work?

Words can be used to survey optometry's situation. Words can be used effectively in pointing out the seriousness of optometry's position. Words can be used to outline the objectives of the A.O.A. But there words cease to be effective. Action is demanded. Where and how shall action be started? Where and how shall that action be kept going, until the important job is finished and the pattern for the future laid down and followed? There can be but one answer.

Whom did we mean when we indicated that "public interest transcends all in eye care"? Who must "recognize the social evolution"? Whose responsibility is it that "favorable public opinion must be created

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[1]James A Palmer. Optometric Ethics and Economics. March 1943. Am. Jour. Optom. & Arch. Am. Acad. Optom.

by ethical service"? Who is in danger because of "optometry's shrinkage"?

We could go on indefinitely, raising questions and trying to place responsibility, but the answer should be the same for every question. Each individual optometrist is the one to whom optometry reaches out for help in this critical and discouraging period.

Will you, the individual optometrist, adjust yourself to social evolution, raise optometry's ethical standards, create favorable public opinion, face optometry's dangerous shrinkage, apply sound economics in practice, join the A.O.A., and aid in obtaining optometry's objectives?

PROCEDURE AND INSTRUMENTATION

by Guy L. DuPlessis

A department wherein discussions will be carried on relative to the value of various experimental and clinical techniques as employed by practicing optometrists, and also in which the instruments used by optometrists in various phases of their work, will be subjected to some critical evaluation.

NEW RIMINGTON DYNAMIC RETINOSCOPE

The new Rimington Dynamic Retinoscope by Bausch & Lomb presents the optometrist with an excellent method of stabilizing patient fixation and securing consistently accurate dynamic findings by a unique watch mechanism which carries constantly changing illuminated test characters around the dial. This invention originated with Dr. Elton H. Rimington of Beverly, Massachusetts.

It is recognized that measurement of the refractive status for any given relationship of accommodation and convergence should be reasonably stable. That this has proved invalid in practice has been due, not to lack of skill or interpretation on the part of the optometrist, but to the actual inattentiveness of the patient.

Heretofore, this lack of control of the patient's attention has resulted in momentary accommodative fluctuations, making it impossible to evaluate the true relationship or to obtain repetitive findings under supposedly similar conditions.

The unique feature of the Rimington Retinoscope is the presentation to the patient of constantly changing test characters at a fixed position, thereby controlling three of the most influential factors in visual

stimulation: brightness, contrast, and motion. The challenge to the patient's perceptive powers demands his utmost attention and assures constant fixation at the desired position.

There are two sizes of test characters on the dial which may be varied by a finger slide, permitting an optional examination distance of 40'' or 20''. The individual figures are visible through the character aperture located at the top of the face plate directly under the retinoscope sighting aperture. The character selector knob, located at the center of the face plate, operates a selective shield so that a clockwise turn will render only the large size characters visible, while a counter-clockwise twist shows only the smaller letters. Total occlusion of all characters is obtained at the intermediate position so that the instrument may be used for static retinoscopy.

ABSTRACTS

A department in which will appear abstracts of the literature of optometry, ophthalmology and applied optics. These will be classified according to the following list, although contributions to all sections will not necessarily appear in each issue.

1. Ocular Refraction.
2. Physiological Optics and Color Vision.
3. Ocular Muscles.
4. Orthoptics and Reading.
5. Anatomy, Histology and Embryology.
6. Ocular and General Pathology.
7. Ophthalmic Lenses and Material.
8. Instruments.
9. Hygiene and Illumination.
10. Applied and Physical Optics.
11. Education, Sociology and Economics.
12. Miscellaneous.

12. MISCELLANEOUS.

MORE ON TIME FACTORS IN REFRACTION. H. Brooks. Optician. (London). 1942, 104, 2680, 7-8.

The author deplores the still present tendency on the part of some optometrists who seem to feel that it is necessary for them to correct all visual problems at the first visit of the patient. Brooks points out that in many individuals more time must be taken in examining the eyes of the patient before a diagnosis can be made and that a fairly large number of cases require visual training which of necessity takes time. The author points out that this additional time will be gladly given the conscientious optometrist by the patient. L. P.

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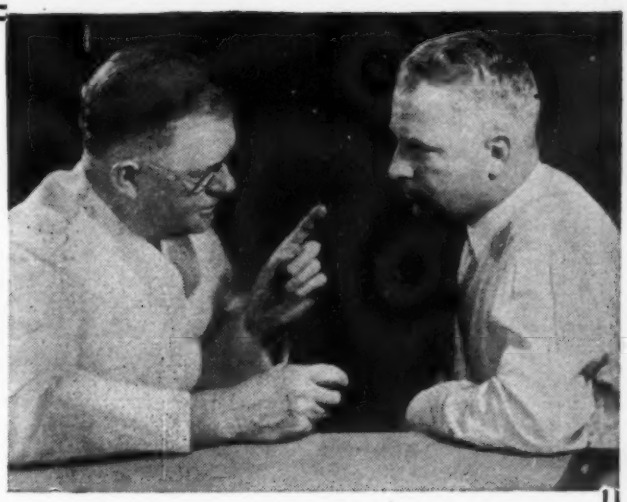

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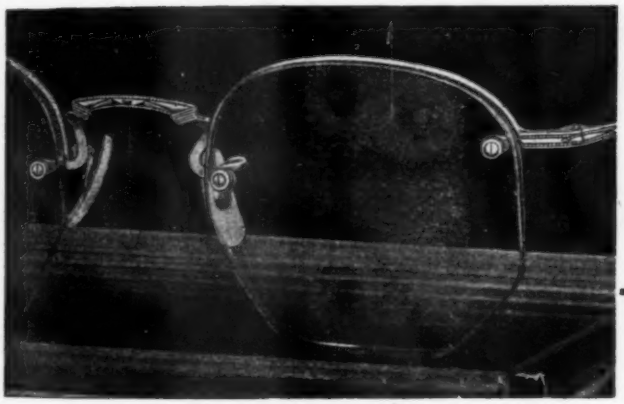

GRACEFUL is the word for CUSHION - MOUNT in the popular rimway vogue. Superb construction by the makers of Cushion-Lock mountings.

Lenses are strain - free, breakage-free, wobble-free.

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The Carlton CUSHION-MOUNT

Improved rimway construction . . . 2-point support maintains lens alignment . . . Backstraps have extra threads to hold screws . . . No metal touches glass . . . Enduring Duratex cushions protect lenses, lock screws . . . Duratex-lined washers insulate lenses from screw-heads . . . Carlton bridge in 10K gold . . . Truflo streamlined temples . . . License-free . . . ASK TO SEE CUSHION-MOUNT.

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The beauty of this superb mounting, combined with its proven practicality, make it an outstanding choice today. Available in a wide range of beautiful bridge styles and designs—all 50/1000 Fine Gold of course.

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SPEEDING VICTORY

Mr. G. L. R., war worker, wore white lenses but complained of photophobia, smarting eyes, headaches, vertigo. Examination showed abnormal sensitivity to light. Soft-Lite Lenses, #1 shade, were prescribed *in the same correction,* bringing relief from all complaints.

Through greater eye comfort with

Soft-Lite Lenses

Name and address of refractionist who reported this case history available upon request.

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3 STYLES
3 MILLIONS

This month SHURSET is just *3* years old—and what a husky lad he has turned out to be. Since *Shuron* introduced this sensational mounting in 1940 nearly *3* millions have been produced with the demand greater today than ever before. And don't forget that there are *3* popular styles—Ronbar, Ronwinne and Ronvail. Your independent wholesaler can supply you.

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